USER'S MANUAL
FIBER OPTIC TRANSMISSION SYSTEM
HIGH RESOLUTION RGB/VGA VIDEO
MODEL 9311T TRANSMITTER
MODEL 9311R RECEIVER

February 27, 2002

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SECTION 1 - INTRODUCTION

1.1 GENERAL DESCRIPTION

The Model 9311T and 9311R Fiber Optic RGB High Resolution Video Transmitter/Receiver pair allows the user to remote the video monitor from the video generator via a much longer distance than allowable via copper coaxial cables. They may also be used when electrical isolation or immunity from noise in the transmission path is required.

There are three optical versions:

A) The “H1” transmitter (using an 865 nm LED)/“S” receiver combination provides a video bandwidth of up to 180 MHz via short fibers. The bandwidth falls to about 105 MHz after approximately 600 meters of fiber and 50 MHz at 1200 meters. For this combination the primary effect on the bandwidth is chromatic dispersion in the fiber, which is not greatly affected by fiber type.

B) The “S” transmitter (using an 850 nm multimode LED) /“S” receiver combination provides a video bandwidth up to 160 MHz via short fibers. The bandwidth falls to 90 MHz after approximately 600 meters of fiber and to 40 MHz at 1200 meters. The primary effect on the bandwidth is the chromatic dispersion, which is not greatly affected by the fiber type.

C) The “LD” transmitter (using a 1310 nm singlemode laser emitter)/“L” receiver combination provides a video bandwidth of up to 220 MHz via short fibers. The bandwidth is valid for the entire link budget.

The units require three optical fibers to operate. The sync signals are combined and sent with the video on these fibers, eliminating the need for a fourth or fifth fiber to carry the sync signals. They support each of the following sync input/output combinations:

INPUT	OUTPUT
Sync-on-Green	Sync-on-Green
External Composite	Sync-on Green
External Horizontal and Vertical	Sync-on-Green
External Composite	External Composite
External Horizontal and Vertical	External Composite
External Horizontal and Vertical	External Horizontal and Vertical

NOTE: VGA, SVGA, XGA, and SXGA fall into the last category.

In the transmitter, all sync signals are first removed from the input(s). Then calibrated sync signals are added to all colors for transmission via the fiber. These sync signals are used as the Automatic Gain Control (AGC) references by the receiver. These sync signals are then removed by the receiver unless operating in Sync-on-Green mode. In this case the sync signal is not removed, allowing it to be present on the Green video output. If external sync signals are input to the transmitter it is possible to use a Sync-on-Green monitor by enabling the Sync-on-Green output at the receiver via an on-board dipswitch. In addition, if Sync-on-Green is input to the transmitter, a separate TTL composite sync will be present at the output. If separate horizontal and vertical syncs are input to the transmitter, separate TTL H&V sync output signals will be available on the HS/CS and VS pins of the HD15 female connector on the receiver. If separate composite sync signals are input it is possible to enable a TTL composite sync from the HS/CS pins of the HD15 connector at the receiver by setting the appropriate on-board dipswitch.

The transmitter will accept external sync inputs of either applied positive or negative going sense and the receiver will return them in the same sense as input. If Sync-on-Green only is utilized, the separate TTL level composite sync output will be negative going. This feature of returning the external sync in the same sense as applied allows the units to be transparent to any video/sync formats (such as VGA) which utilize the sense of the sync signal to help the monitor identify the scan rates utilized.

The transmitter automatically senses the presence external sync signals and configures itself accordingly. If no external sync signals are applied it will operate in Sync-on-Green mode and utilize the sync detected from the Green channel. If a sync input is detected on the HS/CS input and it is recognized as a composite sync (sync OK indicator Green) it will operate in external composite sync mode. If a horizontal sync is detected at the HS/CS input a vertical sync is not, the units will not operate properly (as indicated by a RED Sync OK indicator on the transmitter). If both external H&V sync are applied to the transmitter it will operate in that mode.

VGA/SVGA/XGA resolutions of up to 1840 x 1634 are supported depending on fiber type and model selected. Horizontal scan rates of 15.75 kHz to 128 kHz and vertical rates of 45 Hz to 150 Hz are supported.

The Models 9311T and 9311R are single-width card compatible with the 9000 series of card chassis. They operate on 6VDC power from the chassis backplane. For rack-mount operation use the Model 9002 chassis. For standalone operation use the Models 9003 or 9004.

The Models 9311T and 9311R are compatible with the standalone models 3654AR and 3654AT, respectively, and the older System 5000 compatible Models 5654AR and 5654AT, in the multimode versions only.

See Table 1 for a list of models and options**.**

Table 1 - LIST OF MODELS vs. BANDWIDTH & LINK BUDGET

Model		λ (nm)	BW (MHz) vs. fiber length				Link budget		
TRANSMITTER	RECEIVER		2 m	600m	1.2 km	2.4 km	50/ 125	62/ 125	09/ 125
9311T-S-ST	9311R-S-ST	850	160	90	40	20	N/A	5 dB	N/A
9311T-H1-ST	9311R-S-ST	865	180	90	50	25	4 dB	8 dB	N/A
	9311R/HS-S-ST	865	150	100	50	25	8 dB	11 dB	N/A
9311T-LD-ST	9311R-L-ST	1310	220	220	220	220	N/A	N/A	11 dB
* Depends on fiber distance x bandwidth product									

1.2 PHYSICAL SPECIFICATIONS

DIMENSIONS — See Figures 1 and 2
WEIGHT — 7 oz. (0.2 Kg.)

1.3 ENVIRONMENTAL

OPERATE TEMPERATURE — -20 to 50°C
STORE TEMPERATURE — -40 to 70°C
RELATIVE HUMIDITY — 0 to 95%, noncondensing

1.4 FUNCTIONAL SPECIFICATIONS

1.4.1 OPTICAL

Transmitter

Fiber Type	Power output* (typical) in dBm:		
	-S	**-H1**	**-LD**
50/125 μm fiber	N/A	-16	N/A
62.5/125 μm fiber	-14.5	-11.5	N/A
09/125 μm fiber	N/A	N/A	-11

Receiver

Receiver sensitivity* for 1V p-p output: minimum (typ.)			
Version	**-S**	**-HS**	**-L**
	-19.5	-22.5	-21

*Measured with a white field (white screen) video signal. These measurements vary with Average Picture Level (APL).

1.4.2 ELECTRICAL

Sync-on-Green level — 300 mV (nominal)
Video input level — 700 mV (nominal), 900 mV (max.)

Ext. sync input levels (referenced to ground)			
Low level		- 0.7 to + 0.3 V, typical	
High level		+1.0 to +4.3 V, typical	
Ext. sync output levels into;		75 ohms	300 ohms
Low level		0V	0V typical
High level		+2V	3.2 V typical
Video input/output impedance		75 ohms	
Sync input impedance		75 ohms	
Video/sync connectors		BNC	
Sync source options		1) Sync-on-Green	
		2) External Composite Sync	
		3) Separate Ext. Horizontal and Vertical Sync	
Video linearity distortion		≤3% (typical)	
Video output level mismatch		≤2% (typical) for R, G, and B	
Video back porch clamp level		0V ± 10 mV (typical)	
Output overshoot		≤15%	
Output settling time		≤20 ns to less than 2%	
SNR via 600' link	-H1-	≤45 dB (typical)	
	-S-	≤40 dB (typical)	
	-LD-	≤54 dB (typical)	
Video/Sync Timing Limits		Min	Max.
Horizontal sync pulse width		350 ns	5 µs
Horizontal back porch width		450 ns	
Vertical sync. serration width		350 ns	
Horizontal scan rate		15.75 kHz	128 kHz
Vertical frame rate		45 Hz	150 Hz
Differential delay among RGB video channels (assuming equal fiber delay)		≤ 300 ps	
Absolute video delay		18 to 20 ns (zero length fiber)	
Sync Delay Relative to Video		See Table 2	

Table 2 - SYNC DELAY RELATIVE TO VIDEO

Input Sync	Output Sync	Delay relative to video
Sync on Green	Sync on Green	+33 to +43 ns
	Ext. comp. Sync	+90 to +110 ns
Ext. comp. sync	Ext. comp. Sync	+50 to +60 ns
Ext. horiz. sync	Ext. horiz. sync	+90 to +110 ns
Ext. vert. sync	Ext. vert. sync	H sync width +250 ns

1.4.3 POWER CONSUMPTION

9311T/MM	6VDC @ 1.0 Amps
9311T/SM	6VDC @ 1.25 Amps
9311R/MM	6VDC @ 1.35 Amps
9311R/SM	6VDC @ 1.5 Amps

1.4.4 COMPLIANCES

CE
FCC Part 15, subpart J for class A equipment

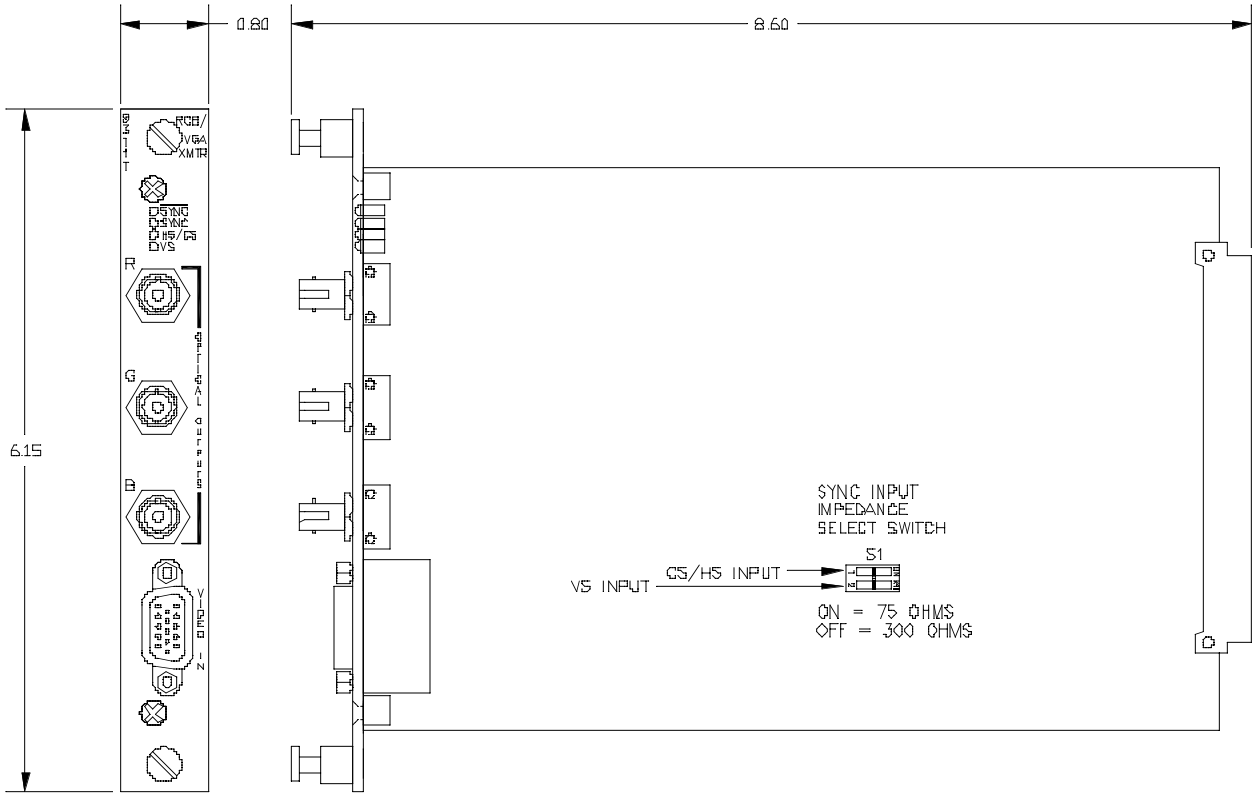

Figure 1 – 9311T DIMENSIONS AND SWITCH LOCATIONS (S and L Versions Shown)

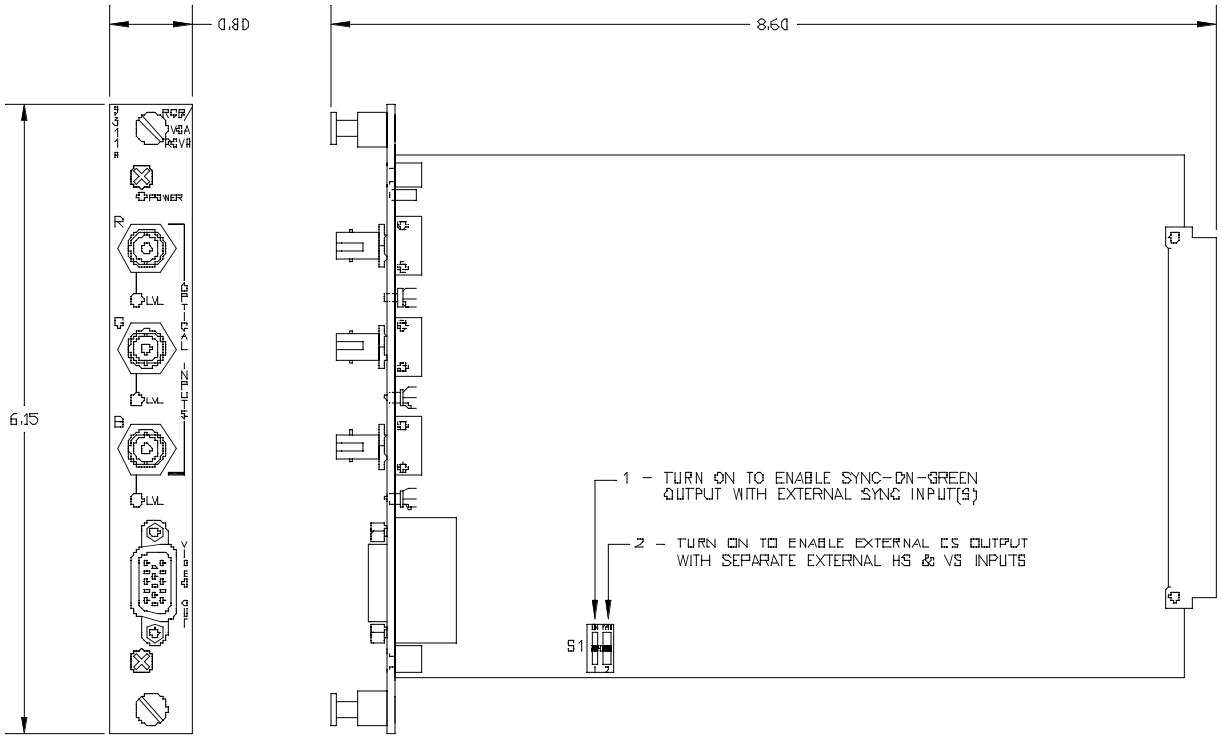

Figure 2 – 9311R DIMENSIONS AND SWITCH LOCATIONS

SECTION 2 - INSTALLATION

2.1 SETUP

Both the Transmitter and Receiver units have two-position dipswitches on the circuit card.

2.1.1 9311T

2.1.1.1 External Sync Input Impedance Select

On the transmitter, a dipswitch is used to select the input impedance of the external sync inputs, HS/CS and VS. See FIGURE 1 for the location of the switch on the circuit card. Position one (1) is for the HS/CS input. Position two (2) is for the VS input. Set the switch OFF for 300 ohms and ON for 75 ohms. Use 300 ohms as the default, 75 ohms if required usually for proper termination of long cables.

2.1.2 9311R

2.1.2.1 Sync-on-Green Output Enable (with external sync inputs)

On the receiver a dipswitch (position #1) allows the user to select a Sync-on-Green output from the receiver in the absence of a Sync-on-Green input. See Figure 2 for the location of the switch on the circuit card. When switch position number one (1) is OFF the receiver will output Sync-on-Green from the Green output only if the transmitter has a Sync-on-Green input with no external sync input. If there is an external sync input there will be no sync signal on the Green output. When this switch is in the ON position sync will be added to the Green output if an external composite sync (CS) is input to the transmitter. This will allow for the use of Sync-on-Green monitors when only an external composite sync (CS) or external horizontal (HS) or vertical syncs (VS) are available at the transmitter.

2.1.2.2 Composite External Sync Output Enable (with separate horizontal and vertical sync inputs)

On the receiver a dipswitch (position #2) allows the user to select an external TTL composite sync output even though separate external horizontal and vertical sync signals are input to the transmitter. This will allow for the use of an external composite sync monitor.

2.2 MOUNTING

To install the Model 9311T or 9311R, plug it into the card chassis

In mounting the chassis itself, make sure there is enough space to connect both the electrical and optical cables to the panel without stressing them beyond the manufacturer's limitations (bend radius minimums).

2.3 POWER CABLING

Power is supplies via the chassis backplane for either a Model 9010 in-line power supply (for the Models 9003 or 9004 chassis) or the Models 9030 or 9050 power supplies (for the 9002 chassis). Follow the instructions in the power supply manual.

2.4 OPTICAL CABLING

Connect a fiber from the R port of the transmitter to the R port of the receiver. Repeat the connections for the G and B ports. Because of optical pulse propagation delay in the fibers, **it is important to make sure the fibers are of equal length to avoid misconvergence of the colors on the monitor.**

Most cable manufacturers identify the individual fibers in the cable. Ensure that the same fiber connects the 'R' optical output port of the transmitter and the 'R' optical input port of the receiver, etc.

When making the optical connections, first remove and save the plastic dust caps from the optical ports on both units and from the fiber terminations. Clean the ends of the fiber per supplier's recommendation. ST connections are made by taking the following steps (see Figure 3, below).

A. ST® OPTICAL CONNECTION

1) Align the key and the bayonet slots on the ST connector with the keyway and the bayonets of the ST optical port.
2) Slide the connector ferrule into the port until the key and bayonets are engaged.
3) Push the coupling nut forward until it can be turned clockwise to lock the connector into the port.

® ST is a registered trademark of AT&T

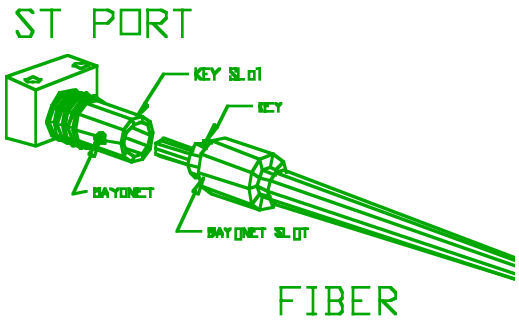

FIGURE 3 – ST CONNECTION

2.5 ELECTRICAL CABLING

The Video and Sync connections are made via the HD15 Female connectors on the front panels of the 9311T and 9311R.

2.5.1 Model 9311T Transmitter

If the video source is a personal computer, the video/sync connection from the computer to the 9311T is most likely made using a standard pin for pin VGA extension cable with a male HD15 connector on one end and a female HD15 connection on the other. If your video source uses BNC connectors for the outputs, use a standard 3,4, or 5 (as required) BNC-to HD15P (Male) adapter cable. All coaxial cables should be the same length.

2.5.2 Model 9311R Receiver

If the receiver will drive a standard VGA monitor with an attached cable, a male-to-male HB15 gender changer will be required to attach to the HD15S connector on the front panel. If your video monitor has BNC inputs, use a standard 3, 4, or 5 BNC-to-HD15P (male) adapter cable (as required). All coaxial cables should be the same length.

SECTION 3 - OPERATION

3.1 TURN-ON PROCEDURE

To operate the units, connect the AC power cords and turn on the power switches on the power supplies (if applicable). Confirm that the indicator lights come on.

3.2 CONFIRMATION OF PROPER OPERATION

If operating properly, the green "SYNC" indicator on the transmitter and all three "LVL" indicators on the receivers will be illuminated Green. Good video transmission will also be in evidence. On the transmitter, if external sync inputs are present, either the HS/CS only or both the VS and HS/CS sync LEDs will be illuminated.

3.3 INDICATORS

Table 3 – 9311T Indicators

Name	Color	Function
SYNC	Green	Illuminates when an acceptable sync input (with both horizontal and vertical components) is detected.
NOT SYNC	Red	Illuminates in the absence of an acceptable sync input
CS/HS	Green	Illuminates when signal activity is detected at the CS/HS sync input port.
VS	Green	Illuminates when signal activity is detected at the VS sync input port.

Table 4 – 9311R Indicators

Name	Color	Function
B LVL	Red/Green	Off if there is an inadequate optical input signal power. Red if there is excess optical input signal power. Green if the optical input signal power is within the AGC operating range.
G LVL	Red/Green	
R LVL	Red/Green	

3.4 ADJUSTMENTS

There are no adjustments required under normal operation.

3.5 TROUBLESHOOTING PROCEDURES

If improper operation is evident, refer to the chart below. Consult the factory if you are unable to correct the problem.

PROBLEM	POSSIBLE REASON	POSSIBLE SOLUTION
SYNC indicator on the 9311T is not illuminated (NOT SYNC indicator is illuminated)	Improper connections	Confirm connections.
No video LVL indicators on the 9311R are illuminated.	No sync on the optical signals into the 9311T.	Is the SYNC indicator on the 9311T illuminated? Check the sync source.
	All optical links are bad, or not connected.	Check the output with an optical power meter. Confirm the fiber attenuation. Clean the fibers. Re-terminate the fibers if needed.
One or two video LVL indicators not illuminated but at least one is green.	One or more fibers have excess loss.	
	One of the transmitter video channels has a bad optical emitter	Check the output with an optical power meter. To meet the specs, a white screen signal should be used.

SECTION 4 – NETWORK SOFTWARE MANAGEMENT SYSTEM

The following status and control is supported:

DIGITAL STATUS BITS

9311T

1) Sync Present at Input
2) External Composite or Horizontal Sync Present at Input
3) External Vertical Sync Present at Input

9311R

1) Red Optical Input Power within AGC Range
2) Green Optical Input Power within AGC Range
3) Blue Optical Input Power within AGC Range

ANALOG STATUS SIGNALS

There are no analog status signals available to the Network Software Management System.

CONTROL BITS

No control bits may be exercised by the Network Software Management System.